CLAIMS

What is claimed is:

1. An over expanded, limited temperature cycle for operating an engine comprising:

a compression process 1-2-3, said compression process 1-2-3 further comprising:

a first compression process 1-2 carried out via an external compressor; and

a second compression process 2-3 carried out by changing the volume of a cylinder of said engine;

a heat addition process 3-4-5, said heat addition process 3-4-5 further comprising:

a first heat addition process 3-4 carried out via injection and combustion of fuel in said cylinder of said engine while maintaining a constant pressure; and

a second heat addition process 4-5 carried out via injection and combustion of fuel in said cylinder while maintaining a constant, limiting temperature;

an adiabatic expansion process 5-6;

a heat removal process 6-7-1, said heat removal process 6-7-1 further comprising:

a first heat removal process 6-7 under a constant volume; and

a second heat removal process 7-1 under constant pressure;

wherein said compression process, said heat addition process, said adiabatic expansion process, and said heat removal process combine to form an over expanded, limited-temperature cycle 1-2-3-4-5-6-7-1.

2. The over expanded, limited temperature cycle of claim 1, wherein the change of volume associated with the compression process 1-2-3 is less than the change of volume associated with the heat addition and adiabatic expansion processes 3-4-5-6.

3. A method for combusting fuel in an engine comprising:

decreasing a first volume of a gas to a second volume;

further decreasing the second volume to a third volume while increasing a pressure and a temperature thereof;

increasing the third volume to a fourth volume at constant pressure while adding a first amount of heat via injection and combustion of fuel in a cylinder of said engine until a predetermined temperature is attained;

increasing the fourth volume to a fifth volume while adding a second amount of heat via injection and combustion of fuel in said cylinder while decreasing the pressure thereof and while maintaining the temperature constant at the predetermined temperature;

increasing the fifth volume to a sixth volume while decreasing the pressure and temperature thereof;

decreasing the pressure to atmospheric pressure while removing heat at a constant volume; and

decreasing the sixth volume to the first volume while removing heat under constant pressure.

4. The method of claim 3, wherein a firing pressure is substantially equal to or less than a compression pressure.

5. The method of claim 3, wherein said first amount of heat corresponds to $Q=T_3 \times [(V/V_3)-1] \times C_p$; wherein

Q is said first amount of heat;

C_p is the specific heat of said gas at constant pressure;

V_3 is said third volume.

6. The method of claim 3, wherein said second amount of heat corresponds to $Q = T^* \times [1-(V_4/V)^{k-1}] \times C_v$; wherein

Q is said second amount of heat;

C_v is the specific heat of said gas at constant volume;

T^* is said predetermined temperature;

V_4 is said fourth volume; and

k is C_p/C_v, where C_p is the specific heat of said gas at constant pressure.

7. The method of claim 3, wherein the step of increasing the fifth volume to a sixth volume is an adiabatic expansion.

8. An engine comprising:

an over expanded, limited-temperature cycle engine adapted to combust fuel by:

decreasing a first volume of a gas to a second volume;

decreasing the second volume of a gas to a third volume while increasing a pressure and a temperature thereof;

increasing the third volume to a fourth volume at constant pressure while adding a first amount of heat via injection and combustion of fuel in a cylinder of said engine until a predetermined temperature is attained;

increasing the fourth volume to a fifth volume while adding a second amount of heat via injection and combustion of fuel in said cylinder while maintaining the temperature constant at the predetermined temperature;

increasing the fifth volume to a sixth volume while decreasing the pressure and temperature thereof;

decreasing the pressure to atmospheric pressure while removing heat at a constant volume; and

decreasing the sixth volume to the first volume while removing heat under constant pressure.

9. The engine of claim 8, wherein a firing pressure is substantially equal to or less than a compression pressure.

10. The method of claim 8, wherein the step of increasing the fifth volume to a sixth volume is an adiabatic expansion.

11. The engine of claim 8, further comprising a scavenging air compressor providing compressed air to said engine.

12. The engine of claim 8, wherein said engine is a two-stroke engine.

13. The engine of claim 12, further comprising a scavenging air compressor, said engine having a two stroke construction comprising:

a first stroke enabling a combustion process at its beginning with an expansion process throughout its entire stroke; and

a second stroke having more than one half of said stroke allocated for exhaust and scavenging processes, with the remaining portion of said stroke allocated for further compression of scavenging air provided by said scavenging air compressor.

14. The engine of claim 13, wherein said engine achieves an expansion process having a longer stroke than the stroke for said compression process.